

# Schematic Maps Based on User-generated Data Applied on Mobile Devices for Tourist Navigation Tasks

Karsten Pippig and Dirk Burghardt

Technische Universität Dresden, Institute of Cartography

**Abstract.** The ongoing progress in the field of mobile cartography opens up new perspectives for tourist-related applications and cartographic presentations. Mobile devices are nowadays well-equipped with multifaceted functionalities, which are used by different services, in particular location-based services. In addition, the development of web 2.0 causes a wide range of user-generated data: photo collections of Flickr and Panoramio, free encyclopaedias like Wikipedia, or free geodata like OpenStreetMap. These data can be made available on mobile map-based applications and likewise be used for touristic purposes on mobile devices; nevertheless, in most cases an adaptation of the content to specific thematic issues is rarely taken into consideration. Users are faced with a lack of an adequate selection of theme-relevant information. Moreover, basic cartographic principles are often not considered and maps are not designed for small displays of mobile devices.

This paper addresses the issues of theme-adapted navigation and visualisation on mobile devices. We highlight the entire processing chain (in analogy with a visualisation pipeline) ending up in a mobile application of tourist navigation on user-generated data. Thereby, we focus on the extraction of user-generated data (1), the filtering of these data and their preparation for tourist navigation tasks (2), and the visualisation on mobile devices (3).

(1) Within our approach, diverse sources of user-generated data are used and combined to extract tourist-relevant information. Via Flickr and Panoramio, relevant places and frequent sightseeing tours are mined from geo-referenced photos and photo collections, respectively. Explicit information in terms of tags and photo statistics (e.g. number of views) is analysed as well as implicit information arising, for example, from spatial-temporal behaviour of users. Furthermore, Wikipedia is used and provides, on the one hand, geo-referenced articles and, on the other hand, articles of do-

main-specific vocabulary. Thus, important information about places by geo-referenced articles is implicitly gained and this information is semantically enriched with other non geo-referenced articles. Thereby, a semantic similarity determination is applied.

(2) The data filtering is carried out for tourist navigation tasks in general and for an individual theme route planning in particular. Theme-related routes can be computed based on a thematic continuum which is derived from photo densities of Flickr and Panoramio, and a ranking of semantic similarities of Wikipedia articles. By applying individual theme routes, user-requirements can be met as the user can self-define the theme and, thus, the route.

(3) The focus of visualisation techniques on mobile devices is set on schematised map presentations. Schematic map presentations are a suitable way to display reduced information amount without losing the purpose of navigation. As shown in user studies, schematic maps are useful in way-finding, for example within urban areas, and as equally effective as topographic maps for specific tasks. On this basis, different schematic presentations in different scales are developed. Amongst others, an egocentric, time-distorted representation of hiking paths is designed taking into account previous filtered information on time requirements from user-generated data. Likewise, representations of hiking paths in terms of a transportation network plan are designed as well.

An own user study will be carried out on the usability of these schematic map presentations for hiking purposes.

**Keywords:** Location Based Services, Mobile Cartography, Mobile Navigation, Schematic Maps, Theme Route Planning, User-Generated Data